

THE BITING MIDGES ECTOPARASITIC ON BLISTER BEETLES  
(DIPTERA, HELEIDAE)

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The first account of heleid midges attacking beetles was published by Peyerimhoff (1917), who observed a species later described by Keiffer (1922) as *Atrichopogon melocsugans* attacking *Meloe majalis* Linnaeus in Algeria. The flies were observed to pursue these large meloid beetles in little swarms and to feed upon the yellow blood from their swollen abdomens without inconveniencing them in any way. In 1921 Hansen reported midges, which Edwards later (1923) determined as *Atrichopogon rostratus* (Winnertz), hovering over a *Meloe proscarabeus* Linnaeus in Denmark, and sometimes attacking it, especially on the soft skin between the first and second thoracic segments and on the under side. The beetle was seriously affected by the gnats' biting and rubbed its sides with its hind legs, but without getting rid of its tormentors. Edwards (l.c.) attributed the formidable proboscis of *rostratus* to these unusual blood-sucking habits, but stated that this species was usually taken on flowers of Umbelliferae. As I will mention later, at least some of Edwards' records are based on misdeterminations.

Following these reports there appeared a number of similar records of *Atrichopogon rostratus* attacking *Meloe violaceus* Marsham in Germany (Korschefsky, 1937) and Sweden (Heqvist, 1948) and *melocsugans* on the same beetle in Finland (Krogerus, 1936; Storå, 1938) and on it and *Meloe proscarabeus* in England (Blair, 1937, 1938). In 1937 Storå described another midge, *Atrichopogon oedemerarum*, from *Oedemera flavescens* (Linnaeus) and *Chrysanthia viridis* Schmidt and *C. viridissima* (Linnaeus), beetles of the closely related family Oedemeridae, in Finland. I believe that most, if not all, of the above records of *rostratus* are misidentifications of *oedemerarum* Storå.

Görnitz (1937) reported some very interesting experiments with the drug cantharidin obtained from meloid beetles. *Atrichopogon brunnicipes* (Meigen) was regularly attracted to exposed plates containing cantharidin powder. This species is a member of the subgenus *Kempia*, with hairy eyes, and has never been observed actually to feed on blister beetles.

The only published notice of midges attacking meloids in America was by Farr (1954), who sent me specimens of an apparently undescribed species which he found attacking meloids at Amherst, Mass. There are specimens which I have identified as *oedemerarum* in the U. S. National Museum, collected on blister beetles in 1936 and 1937 by J. C. Bridwell. In the summer of 1953 I observed a third and apparently new American species attacking blister beetles in the Chiricahua Mountains of Arizona.

I am greatly indebted to the following persons who have made this study possible: L. G. Saunders of the University of Saskatchewan at Saskatoon and Edward I. Coher and Thomas H. Farr of the University of Massachusetts at Amherst for furnishing specimens; Paul Freeman of the British Museum (Natural History) in London, J. Collart of the Institut Royal des Sciences Naturelles de Belgique in Brussels, S. L. Tuxen of the Universitetets Zoologiske Museum in Copenhagen and Richard Frey of the Museum Zoologicum Universitatis in Helsinki for the loan of cotypes and authentic material of the European species; Karl Mayer of the Biologische Zentralanstalt für Land und Forstwirtschaft in Berlin-Dahlem for calling my attention to Görnitz' studies and for furnishing me specimens from his own cantharidin captures; and G. B. Vogt and T. J. Spilman of the Entomology Research Branch in Washington for determinations and advice concerning the Meloidae and Oedemeridae.

My terminology is the same as I have used in an earlier paper (1952) on the Heleidae of California. The types of the new species are deposited in the U. S. National Museum in Washington, D. C., and paratypes will be furnished the British Museum, the University of Massachusetts, the Museum National d'Histoire Naturelle in Paris and the Institut Royal d'Histoire Naturelle de Belgique in Brussels.

Genus *Atrichopogon* Kieffer

Subgenus *Melochelea* Wirth, new subgenus

The type species of this subgenus is *Atrichopogon meloesugans* Kieffer, and other included species are *Atrichopogon oedemerarum* Storå and the two new species described below. In addition to their meloid-attacking habit, these species are characterized by an unusually upcurved proboscis, a character which I presume to be adaptive for this feeding habit and possessed by no other species of the genus. In addition these species have in common characters which taken alone are also found in other species of *Atrichopogon*, but which in combination will set them apart:

Eyes bare; proximal flagellar segments very short and disciform, the last five segments of the antennae together only 1.8 to 2.3 times as long as the preceding eight combined; palpal pit deep, near middle of third segment; mesonotum with a distinct light-colored area, or fenestra, just ahead of each end of the scutellum, extending forward as narrower, slightly impressed lines to the anterior margin of the mesonotum; scutellum with four long bristles; costa extending 0.65 to 0.70 way to tip of wing; hind basitarsus very nearly 2.5 times as long as the second segment; tarsal claws simple, not toothed or bifid at apices; empodium long, with many long tenent hairs with disc-like apices; two subequal, pyriform spermathecae.

In this subgenus the male of only *meloesugans* is known and is described below, but since the male genitalia offer very poor characters in distinguishing species in other sections of the genus, it seems ade-

quate for the present to recognize the meloid-attacking species as a subgeneric category based primarily on the female sex.

KEY TO FEMALES OF THE KNOWN SPECIES OF THE SUBGENUS MELOEHELEA

- 1. Wing hairy to base, 30-50 macrotrichia in anal cell; head with axis of proboscis more nearly perpendicular to that of body; third palpal segment 2.9-4.0 times as long as broad ..... 2
- Wing nearly bare at base, 10-15 macrotrichia in anal cell; head markedly forward protruding, the ventral surface elongated with axis of base of proboscis more nearly parallel to that of body; third palpal segment 2.4 times as long as broad ..... 3
- 2. Mesonotum subshining dark brown with dark brown pubescence; legs brownish; halter entirely pale yellowish; mandible stout distad, with about 20 large teeth and 6-7 minute distal ones. (Europe and North Africa) ..... *meloesugans* Kieffer
- Mesonotum pruinose gray brown with pale yellowish pubescence; legs and often coxae, palpus, clypeus, antennal pedicel and humerus yellowish; halter with brown stem and white knob; mandible quite slender and pointed distad, with about 14 large teeth and 5 minute distal ones. (Europe and North America) ..... *ocdemerarum* Storå
- 3. Second radial cell 2.1 times as long as first; antenna shorter, last five segments 1.9 times as long as preceding eight combined; mandibles straight, the outer serrate margin slightly convex, with about 11 large teeth and 4-5 minute distal ones; third palpal segment with deep sensory pit. (Western North America) ..... *epicautae*, new species
- Second radial cell 2.5-2.9 times as long as first; antenna long, last five segments 2.2-2.3 times as long as preceding eight combined; mandible broad and curved like a saber, the outer serrate margin straight to concave with 6-7 very large teeth and 4-5 minute distal ones; third palpal segment with shallow pit. (New England States) ..... *farri*, new species

**Atrichopogon (Meloehela) meloesugans** Kieffer

(Figure 1)

*Atrichopogon meloesugans* Kieffer, 1922, Arch. Inst. Pasteur Afr. Nord 2:495 (♀; Massif de Mouzaia, Algeria; figure ♀ antenna); Krogerus, 1936, Notulae Ent. 16:27 (Kuusano, Finland; habits); Blair, 1937, Ent. Mo. Mag. 73:143 (England); Blair, 1938, Proc. Trans. S. London Ent. & Nat. Hist. Soc. 1937-38, p. 84 (ditto); Storå, 1938, Acta Soc. Fauna Flora Fennica 60:256 (Finland).

Through the kindness of Paul Freeman of the British Museum (Natural History) I have been permitted to study two cotypes of Kieffer's series collected by Peyerimhoff in Algeria, as well as one of the specimens collected by Blair in South Devon, England, and determined as *meloesugans* by Edwards.

Critical characters observed on the pinned type material from Algeria: Color dark brown, including head, antenna, palpus, thorax, abdomen and hairs on the mesonotum; legs and wing dusky brownish-yellow; halter yellowish white. Antenna with the last five segments 2.0 times as long as the preceding eight

combined. Hind basitarsus 2.5 times as long as the second segment. Wing 1.5 mm. long, costa to 0.71 length of wing, second radial cell 2.1 times as long as first; wing quite hairy, macrotrichia extending proximad of the intercalary fork in cell R5, to base of cell M1 and over nearly all of anal cell.

The female from S. Devon, England, was mounted on a slide and it agreed with the Algerian specimens with the addition of the following characters:

About 20 large teeth and 6-7 minute distal ones on the mandible; palpal segments in proportion of 10:30:50:20:20, third segment slender and 3.2 times as long as broad, the pit not so deep as in *oedemerarum* Storå, with a small sensory pore (fig. 1).

A male and a female specimen of *meloesus* from Strelley, Notts, England, 3 November 1922, L. G. Saunders, reared from larvae, was kindly furnished for study by Dr. Saunders. The female differs slightly from the specimens noted above in having the third palpal segment very long and slender, 4.0 times as long as broad, with shallow sensory pit; antennal ratio 2.4; second costal cell 2.3 times as long as first; tarsal ratio 2.3 and the mandible more slender distad. The shallow palpal pit and small, numerous (20 plus 6) mandibular teeth are typical of *meloesus*, however. The male specimen, apparently the first of this subgenus to be recognized, is characterized by the same up-curved proboscis as the female. In addition the tarsal claws are slenderer than in the female, with minutely bifid apices. The male genitalia are of the usual structure for the genus, without characteristic modifications. Ninth tergite rounded, without prominent apicolateral processes; ninth sternite with a single, irregular, transverse row of about 15 hairs; dististyles moderately stout distad and bearing a small, peg-like distal appendage just before the apex on the extensor side; aedeagus with the mesal lobe broad, caplike and bent ventrad.

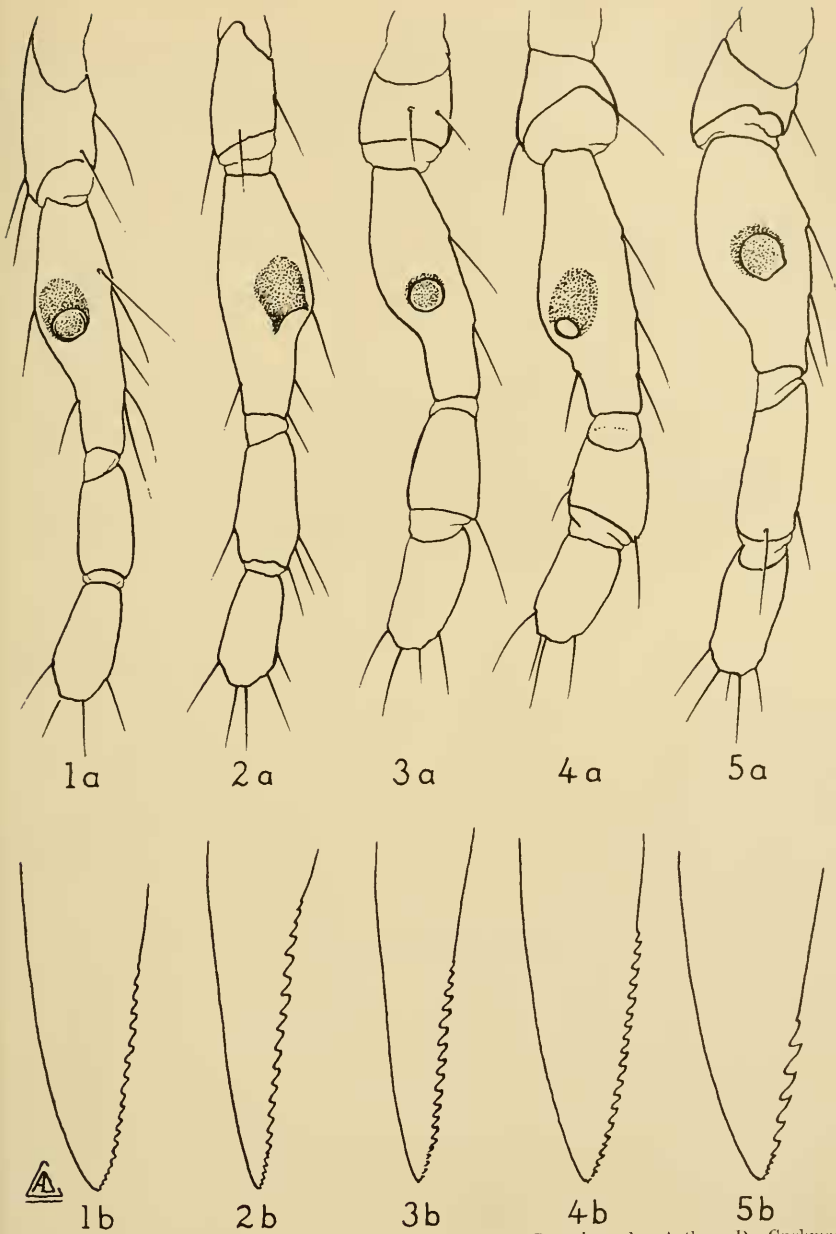
(*Atrichopogon (Melohelea) oedemerarum* Storå

(Figures 2, 3)

*Atrichopogon oedemerarum* Storå, 1939, Notulae Ent. 19:16 (♀; N. Lojo, Kaikuma, Finland).

*Atrichopogon rostratus* of authors (not Winnertz, 1852); Edwards, 1923, Ann. Trop. Med. Parasit. 17:27 (Denmark, notes); Korschefsky, 1937, Arb. Phys. angew. Ent. Berlin 4:157 (Germany); Heqvist, 1948, Opusc. Ent. 13:47 (♀ fig., Sweden).

Through the courtesy of Richard Frey of the Museum Zoologicum Universitatis of Helsinki, I have been able to examine four females of *oedemerarum* from Siilinjarvi and Kurkijoki, Tiensuu, Finland. To the original description I can add the following characters which will serve to distinguish this species from the other three in the subgenus:



Drawings by Arthur D. Cushman

*Atrichopogon* species: a, female palpus, b, apex of female mandible. Fig. 1, *mcloosugans* Kieffer, from England; fig. 2, *oedemerarum* Storå, from Finland; fig. 3, *oedemerarum* Storå, from Massachusetts; fig. 4, *epicaulæ*, n. sp., from Arizona; fig. 5, *farri*, n. sp., from Massachusetts.

Antennal ratio 2.2; palpus long, the third segment (fig. 2) very slender, 3.5 times as long as broad, with a deep sensory pit opening beyond the middle of the segment; mandible quite slender and pointed distally, the serrate outer margin nearly straight and bearing about 14 large teeth and 5 minute distal ones (fig. 2).

I have also examined the following European specimens which agree quite well with *oedemerarum*:

One female (kindly loaned by Paul Freeman) from Cambridge, England, reared by L. G. Saunders, 6 February 1923 from larvae on damp wood, preserved in alcohol. This specimen was mounted temporarily on a slide in phenol, where the following features were observed:

Fourteen large teeth and 5 minute distal ones on mandible; palpal pit very deep; antennal ratio 2.2; tarsal ratio 2.2; costa to 0.65 wing length, second radial cell 2.3 times as long as first; wing 1.4 mm. long; mesonotal pubescence pale; palpi and legs including coxae yellow.

Two females were received in exchange from Willi Hennig of the Deutsches Entomologisches Institut, collected in Munich, Germany. These specimens have the mesonotum strikingly burnished gray pruinose; one was mounted on a slide for examination:

Mandible with 16 large teeth and 5 minute distal ones; antennal ratio 2.4; costa to 0.69 wing length (1.5 mm.); second radial cell 2.3 times as long as first; tarsal ratio 2.5; palpal segments in proportion of 10:10:38:20:20, third segment 3.1 times as long as broad, with a very deep pit opening by a narrow pore; macrotrichia covering nearly all of wing, except bare along veins.

Seven females (kindly loaned by S. L. Tuxen) from Frederiksdalsskov ved Kulhus, Denmark, collected by H. Anthon 22 May 1937 on *Meloe violaceus* Marsham (beetle determined by T. Spilman).

The following specimens of *oedemerarum* from North America are in the U. S. National Museum: *Virginia*: 17 females, Vienna, 7 July 1937, J. C. Bridwell, on *Epicauta fabricii* (Leconte); 4 females, Dunn Loring, 27 June 1936, J. C. Bridwell, on *E. fabricii* (Leconte); 1 female, Dead Run, 21 May 1914, R. C. Shannon. *Maryland*: 1 female, Plummer's Island, 19 May 1914, R. C. Shannon. *Massachusetts*: 3 females, Amherst, 1 July 1952, T. H. Farr and F. R. Shaw, on *E. fabricii* (Leconte). *New Hampshire*: 1 female, Mt. Washington, Mrs. Slosson. These specimens fall within the range of variation of the European material examined except that the sensory pit on the third antennal segment is considerably shallower (fig. 3). In each of the three longer American series, there is evidence of marked color variation, the most extreme pale specimens with all coxae, the palpus, clypeus, antennal pedicel and humerus of the mesonotum pale yellow.

In addition to the alcoholic specimen of *oedemerarum* recorded above I received on loan from the British Museum (Natural History) a pinned series of *Atrichopogon* not evidently associated in any way

with meloids, determined as *rostratus* (Winnertz) by Edwards and in part reported by him in his 1926 paper. Some specimens in this series which have dark halteres and a short, straight proboscis are evidently misdetermined. The remaining specimens of the series, with very long, straight proboscis and pale halter knobs are identical with specimens I have received from the Institut Royal d'Histoire Naturelle de Belgique determined as *rostratus* by Goetghebuer. Characters of these specimens which agree with Winnertz' original description and together serve to exclude *rostratus* from *Melochelea* at the longer costa (attaining 0.78 of wing length, as measured by Winnertz from the extreme root of the wing), larger size (wing about 2.0 mm.), dark halter stem and milk-white knob and the virtual absence of macrotrichia in the mediocubital and anal cells of the wing. This species is also characterized by the presence of two, subequal, pyriform spermathecae; long, slender third palpal segment with a small sensory pit at the extreme tip and the teeth becoming progressively stronger toward the tip of the mandible. The North American *fuscus* (Coquillett) is very closely allied to, if not identical with, *rostratus*.

***Atrichopogon (Melochelea) epicautae*, new species**

(Figure 4)

*Female*:—Length about 1.75 mm., wing 1.4 mm. by 0.65 mm.

Head dark brown including all of antenna, clypeus and palpus. Eye bare. Antenna with flagellar segments in proportion of 12:10:10:10:10:11:11:12:30:32:35:35:50; last five combined 1.9 times as long as preceding eight combined, basal flagellar segments much broader than long, their length gradually increasing and width decreasing toward tenth segment which is nearly as long as broad; last segment with a long terminal nipple. Distal four palpal segments in proportion of 15:35:20:18, third or antepenultimate segment swollen in middle with deep pit and small sensory pore (fig. 4). About 11 large teeth on mandible, plus 4-5 minute distal ones (fig. 4).

Thorax dull dark brown, with sparse yellowish-brown pubescence; two very narrow pale brown lines extending forward from ends of scutellum; latter dark brown with four brown bristles. Legs including coxae dull brownish, mid and hind pairs slightly darker. Proportions of segments of hind leg from coxa distad 50:20:135:130:70:28:22:15:18; basitarsus thus 2.5 times as long as second segment. Claws simple.

Wing with costa extending two-thirds way to wing tip, first radial cell not quite half as long as second. Macrotrichia very sparse, in cell R5 extending only from end of costa along wing margin to wing tip and filling intercalary fork; present only in apical halves of cells M1, M2 and M4 and here well removed from the veins, only about a dozen hairs in anal cell in central region. No hairs on membrane of proximal half of wing except those in anal cell. Halter with brown stem and white knob.

Abdomen with the extensive pleural membrane yellowish, the narrow tergal and sternal plates dark brown. Spermathecae two, subequal, slightly pyriform.

Holotype female (Type no. 62405, U.S.N.M.), Rustlers Park, Chiricahua Mountains, Ariz., 25 June 1953, W. W. Wirth. Paratypes: 38 females, same data as type; 2 females, Eureka Calif., 22 May, H. S. Barber; 1 female, Kaslo, British Columbia, 18 June, R. P. Currie; 1 female, Bear Lake, British Columbia, 20 July 1903, R. P. Currie; 1 female, North Fork Ranger Station, Glacier National Park, Mont., 30 May 1926, H. G. Dyar (all in U.S.N.M. collection).

The Arizona specimens were attacking *Epicauta cinctipennis* Chevrolat (beetles determined by G. B. Vogt) which were damaging lupines at the top of a divide, at about 7000 feet elevation. The midges were observed to feed successfully on the beetles by alighting on plants beside them and reaching over with the proboscis to pierce the beetle at the base of a leg. Those which attempted to alight on the beetles were repelled as the beetles scrambled away over the foliage. Characteristic groups of the beetles would each have a little swarm of the midges flying a few inches overhead, resting on nearby foliage or attempting to feed.

The sparsely hairy wing and heavily toothed mandible ally this species with *farri* n. sp. which however, has longer distal antennal segments, a longer second radial cell and extremely heavily sclerotized and curved mandible with fewer teeth.

***Atrichopogon (Melochelela) farri*, new species**

(Figure 5)

*Female*:—Length about 1.2 mm., wing 1.3 mm. by 0.56 mm.

Head dark brown including antenna and palpus; eyes bare, broadly meeting above. Antenna with flagellar segments in proportion of 15:10:10:10:12:12:13:15:22:35:40:60; last five segments 2.3 times as long as preceding eight combined, distal segment with long terminal nipple. Palpal segments in proportion of 10:25:30:20:20, third segment scarcely swollen with pit less than half as deep as in *ocdemerarum* Storå (fig. 5). Mandible very stout and markedly out-curved, the serrate outer margin concave, with about seven very large and four or five minute distal ones (fig. 5).

Mesonotum and scutellum subshining dark brown with very faint grayish luster, the pubescence dark gray; four dark brown bristles on scutellum. Pleuron and coxae dark brown; legs distally dull yellowish brown. Proportion of segments on hind leg from coxa distad 50:20:125:125:65:25:17:11:16, hind basitarsus 2.6 times as long as second segment.

Wing with costa extending 0.70 way to wing tip, second radial cell 2.5-2.9 times as long as first; macrotrichia very sparse and only a few on basal half of wing except on veins, about ten or fifteen in middle of anal cell. Halter with pale brown stem and white knob.

Abdomen dark brown, the pleural membranes paler. Two subequal pyriform spermathecae.

Holotype female, Amherst, Mass., 1 July 1952. T. H. Farr (Type no. 62406, U.S.N.M.). Paratypes: 5 females, Framingham, Mass., 18 June 1904, C. A. Frost, on *Epicauta torsa* (Leconte) (3 returned



to C. W. Johnson collection at Boston University, 2 retained in U.S.N.M.); 3 females, Franconia, N. H., Mrs. Slosson.

I am pleased to name this species in honor of Mr. Thomas Farr, who published a note (1954) on the habits of these midges, which were attacking *Epicauta fabricii* (Leconte) at Amherst.

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**AN EASTERN EXTENSION OF THE RANGE OF THE MOSQUITO  
 CULEX APICALIS ADAMS<sup>1</sup>**

(DIPTERA, CULICIDAE)

*Culex apicalis* Adams is a member of the subgenus *Ncoculex*. Until 1948 it was assumed that this subgenus was represented in the United States by a single widely distributed species that was designated as *Culex apicalis*.

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